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NEW TYPE OF MEETING DEVELOPED BY EASTERN SECTION, ASSOCIATION OF GEOLOGY TEACHERS

MAURICE B. ROSALSKY
City College of New York

ABSTRACT. A new type of informal meeting has been developed in the Eastern Section, Association of Geology Teachers. This meeting takes place at a college in the Section area once a year at a time and place other than that of the formal annual meeting. The purpose of the get-together is to inspect the facilities, discuss the course offerings, teaching techniques, and basic educational philosophy of the college selected.

The Eastern Section of the Association not only has a formal annual meeting of the Section each spring but now has in addition an informal annual meeting at a college within the Section area.

This paper implements the suggestion of our former president John H. Moss of Franklin and Marshall College, Lancaster, Pennsylvania, to encourage similar gatherings in other Sections.

Our first meeting of this type occurred on Saturday, April 14, 1956 with an all-day visit to the Geology Department of Bryn Mawr College, Bryn Mawr, Pennsylvania selected as an example of a strong department in a small liberal arts college. Twelve geologists from Bryn Mawr, Franklin and Marshall, Lafayette, and Rutgers participated. They inspected the facilities, discussed the course offerings, teaching techniques, and basic educational philosophy of Bryn Mawr.

Our second meeting took place on Saturday, December 1, 1956 with an all-day visit to the Geology Department at City College of New York selected as an example of a department facing the problems of operating in a big city. Twenty-one geologists from Barnard, C.C.N.Y., Columbia, Franklin and Marshall, Hunter, Lehigh, Princeton, Rensselaer Polytechnic, and Rutgers (Newark) participated.

In the morning, George Adams and other members of the Geology Department of C.C.N.Y. spoke to the group on a tour which included the seismograph station and visual recorder, lapidary room, weather station, departmental library, class rooms, laboratories, shop and offices.

A most valuable part of the get-together, a part that should be brought to the attention of all the Sections, was the afternoon round-table discussion dealing with course offerings, teaching techniques in laboratory, field, and lecture, and basic educational philosophy. Although such a discussion frequently takes place

at the regular annual meetings of the various Sections it is generally subordinate to the main topic of the meeting.

The discussion opened with a statement by George Adams of the aims of the elementary course in Geology. It is a valuable course in terms of the student's understanding the world he lives in, one of the stated aims of the College of Liberal Arts and Science. It is particularly valuable for city dwellers to be acquainted with the physical world beyond the bricks and concrete of the city. City dwellers are more apt to be familiar with their social, economic, and political environment than with their geological surroundings.

It was soon apparent that the various participants also wished to compare their situation with that at C.C.N.Y. This was an important by-product of the meeting.

At C.C.N.Y., the first course of Geology has three laboratory and two lecture hours weekly. The two lecture hours, which total thirty hours for the semester, are handled in quite an unusual manner. Instead of having one or two lecturers, ten lecturers alternate each giving that phase of the course which he is best qualified and most interested in! The students have reacted most favorably to this system. Another advantage that the undergraduates of C.C.N.Y. have is the fact that contrary to the usual practice, experienced members of the staff instead of graduate students are in charge of laboratory sections. A laboratory section handled by a dedicated teacher is not the same as one handled by a graduate student whose teaching is not his main interest.

The elementary students actually take four or five field trips using subways and buses for transportation. They study outcrops of igneous, sedimentary, and metamorphic rocks and see examples of faulting, jointing, plunging folds, weathering, river, glacial, and shoreline features, all in the immediate Metropolitan area.

Various points were raised including the question of what is to be done about geology students who enter the elementary course with no background in Physics, Chemistry, or Biology. In some colleges, students are required to take courses in other sciences as prerequisites to Geology. It was pointed out, however, that simple concepts in Physics and Chemistry can be put across to the students in the first course in Geology. At some colleges a one hour lecture is given in Chemistry before minerals are taken up. Moreover, a student taking courses in Geology may see the need for knowledge of chemistry and may acquire the motivation to take a course in it.

At the present time a thousand students per year take the one semester elementary course as a terminal course. Surprise was evoked by the number of Geology Majors, currently sixty.

There was quite a discussion about the list of courses in Geology for the Geology Major. Considerable variation in curricula between institutions was noted. In some colleges a student must follow a rigid sequence of geology courses having many prerequisites. However at C.C.N.Y., for example, many different curricula are offered for a variety of reasons. First there is a constant change in student population with students entering geology from other divisions and

departments of the college at different levels, with different backgrounds. Among students who already know their dominant interest within geology, one interested in geophysics takes a different program from one interested in paleontology. Also with a large student population to draw from and enrollment limited in each course, a student may not be able to gain admittance to a course and hence cannot follow a rigid sequence. Of course an attempt is made to follow a sequence but the sequence cannot be rigidly maintained.

There was no agreement as to what should be the prerequisites to Field Courses. It was pointed out that such prerequisites may vary depending on whether the college is in an igneous, sedimentary or metamorphic rock area. At C.C.N.Y., Historical Geology, Structural Geology, Physiography and Invertebrate Paleontology are prerequisites to four weeks of summer field work.

In a discussion of Plane Tabling it was found that at some colleges Plane Tabling is given by the Engineering Department, while at others the subject is given by the Geology Department. In the former case, Plane Tabling is commonly a second or third course, with the Engineering Department insisting that other surveying courses be taken first. It is sometimes hard to convince them to allow the Geologists to take Plane Tabling without the other surveying courses.

Another subject discussed was the place of statistics in a geological curriculum. In many colleges statistics is given in the Mathematics, Economics, or Psychology departments with no explanation of its application to geology. It was felt that there is a real need for a course in Geological Statistics. A book on "Statistics in Geology" by Miller and Kahn (Chicago University) is in preparation.

The group was impressed by the fact that despite the handicap of being in a large city, geology is taught at C.C.N.Y. just about as in out of town colleges.

In conclusion I think that all members would agree that any Section would be healthier and more vigorous with two instead of one meeting per year. These two meetings should be if possible in different areas of the Section, a policy which will tend to maintain interest in the Association in different local areas of the Section.

PUBLICATIONS OF THE GEOLOGICAL SURVEY OF CANADA

During the last six months of 1956, the Geological Survey of Canada has issued many maps and papers of interest to geology teachers in the United States. Notice of publication is sent on request to all those interested; write to: Geological Survey of Canada, Department of Mines and Technical Surveys, Ottawa, Ontario, Canada, if you wish to be placed on the mailing list. Lists are numbered, printed in postcard form or mimeographed on 8½ x 11 paper, and sent out about twice a month.

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THE OPEN-BOOK EXAMINATION IN INTRODUCTORY GEOLOGY COURSES

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ABSTRACT. Use of the open-book examination in introductory geology courses has proved a useful technique because it tends to force students to rely on their reasoning ability rather than on their memory. It results in a marked reduction in classroom cheating. It provides, when used with individual conferences, a satisfactory means for evaluating student progress. When used with essay answers, it provides the student with an opportunity to pursue a variety of logical paths to the correct conclusion.

Disadvantages center around the mechanics of preparing and grading such examinations and around student resistance to any new or unfamiliar approach. In addition, an instructor adopting this type of examination must be prepared to devote considerably more time than is customary to individual student conferences.

INTRODUCTION

In approximately fifteen years the writers have used open-book examinations in all introductory courses in geology and geography, at both freshman and junior levels. This type of examination for geology classes was first introduced by Webb in 1939 at the University of California, Los Angeles, and was adopted by Norris at Santa Barbara College in 1952.

An open-book examination permits the student use of lecture notes, textbook, atlases and other reference materials of his choosing in the examination room. Initial experience with such examinations is commonly frustrating to the student who wastes much time in fruitless search of references for exact answers to questions, for answers he thinks will please the instructor, or for "authoritative" answers from the textbook. This kind of activity is a prominent feature of first examinations each semester, but it decreases steadily as students learn that correct and complete answers for well-composed examinations cannot be found in the reference materials, but must be supplied by simple reasoning and logical thinking. Reasoning is a process avoided where possible by a majority of college students, including many of the more successful ones. This seems to be possible because many students find it not only satisfactory, but relatively simple, to memorize a multiplicity of facts, frequently unrelated, and to report these faithfully on examinations for highly creditable grades. At the conclusion of such a procedure, it is suspected, a widespread belief prevails among both students and instructors, that the learning process has taken place and much knowledge transferred. In addition, an examination based on memorization lends itself readily to the almost universally deplored practice of cramming, and to a lesser (or greater) extent to the allegedly universal practice of cheating.

PURPOSES OF ANY EXAMINATION

Examinations in college classes should fulfill at least two functions: (1) To improve the learning situation by providing learning in itself, contributing at the

same time to the teaching process and the improvement of the student's grasp of the subject material. Closed-book examinations may be woefully weak in these respects. (2) Where conventional grading systems are employed by the institution, the examination should provide an evaluation of attainment.

It is not to be inferred that the writers believe all closed-book factual examinations are undesirable. It is suggested, however, that the open-book examination is equally as effective as conventional type examinations in those courses prerequisite to advanced specialized courses, and far more effective than conventional examinations in courses where many basic concepts are presented that need to be thoroughly understood as part of preparation for "living in the modern world"—in short, in general education courses.

CHARACTERISTICS OF OPEN-BOOK EXAMINATIONS

In practice, essay answers on open-book examinations are often presented, although this method of answering does not necessarily give the best result. Essay answers have the advantage of permitting students considerable latitude in expression; frequently correct answers are presented which had not previously occurred to the instructor when the examination was prepared. Moreover, the essay answer allows students free use of diagrams and drawings whenever these are judged appropriate. The so-called objective examination, employing multiple choice, true-false and short answer questions can be used with the open-book examination, but these restrict the students' freedom of expression considerably and often prevent unique, but nonetheless correct lines of reasoning in obtaining answers. However, toward the close of a semester, after having read many rambling, long-winded essay answers, the writers are strongly tempted to encourage brevity and clarity by some or all of the above means. To date, the compulsion to shorten the reading time and not curtail the reasoning process by "objective" questions has been satisfied by using a technique of limiting space for writing by using mimeographed sheets with a specified amount of writing space, or by requiring the selection of an answer from several choices with justification of the choice in a sentence or paragraph.

When open-book examination questions are carefully drawn, students will find that answers cannot be obtained *in toto* from references, at least not efficiently, and must be reasoned or synthesized from available data previously organized, studied, memorized and understood. A few perceptive students quickly learn that they are more successful when they use their references the least and their brains the most. Occasionally a student, usually one of latent brilliance, addicted to last minute cramming, is unable to follow his traditional pattern on a given examination for social or other reasons and will discover to his astonishment that he does better on the examination the next day than ever before because he ***had*** to depend upon his intelligence rather than upon his memory!

Questions well-adapted to the open-book examination can be equally successful on closed-book examinations. However, questions requiring rote memory, such as definitions, cannot be used directly on an open-book examination unless the instructor wishes to test the relative efficiency of students in searching reference

materials. However, the care with which definitions and terms have been reviewed and understood, and often memorized, may be evaluated since students who depend upon reference materials to provide all definitions are time-pressed. Good open-book examinations require careful budgeting of examination time; open-book examinations are prepared with a view of pressing even the best students to careful pre-examination organization, or inevitably the examination is unfinished in the allocated time.

Some examples of typical open-book examination questions used in introductory geology and geography courses are:

(1) Why are beach sands composed mostly of quartz grains?

(2) What evidences are available that volcanoes in prehistoric times erupted gaseous, liquid and solid products? Do not assume any conversations with old Indians.

(3) Why are dunes characteristic of deserts?

(4) Why are salt lakes confined normally to desert regions?

(5) Explain five different ways in which islands may be formed.

(6) What time of day does the full moon rise?

(7) Describe three ways, not including chemical analysis, which prove that a stream carries some of its load in solution.

(8) Why is a group of fossils generally more accurate than a single fossil in providing the geologic (relative) age of the rock containing them?

(9) Suggest how a geologist might be able to plot, on a map, the approximate direction and length of an active submarine fault without recourse to soundings.

(10) Explain clearly how the geologic age of an unconformity may be obtained.

(11) Why are the following important to a geologist? (a) dip and strike (b) mineralizers (c) tsunami (d) pumice (e)cupolas (f) secondary enrichment, etc.

(12) How will you recognize the following in the field? (a) fault-line scarp (b) eroded fault scarp (c) granite (d) drumlin (e) crag and tail (f) subsequent stream, etc.

(13) How would you distinguish boulders or cobbles in a conglomerate from concretions?

(14) A stream is said to have its transporting power related to its velocity. How is velocity (a) increased and (b) decreased?

ADVANTAGES

Several advantages of the open-book examination have been mentioned: namely, the teaching function that is performed by forcing the student to apply logical thinking to the problem, and the testing value that gives some insight into the extent of the student's understanding of the subject.

Another important advantage accruing is the marked reduction in the frequency of all forms of cheating. Inasmuch as students are free to bring to the examination room whatever materials of reference they desire, it is pointless to prepare microscopic summaries on thumb nails, shoe tops, slip hems and the like. The tendency to copy a neighboring paper is still, of course, present to some degree. On an open-book examination, however, students generally feel the pressure of time and are loath to idly scan other nearby papers. Moreover, it appears that students are often willing to trust the memory of other students, but rarely willing to trust the reasoning ability of their associates.

Despite the obvious mental pressure created by the open-book examination, most students confess, by the close of the semester, that they liked the examinations. When students are polled on this subject early in the semester, it is common for the majority to express dislike for the examinations because of the unaccustomed mental exercise required, the newness of the experience, and the high percentage of low grades in the class.*

At the conclusion of the final examination each semester, every student is asked to record his opinion of the course, the instructor, the examinations, the fairness of grading, etc., on an unsigned mimeographed questionnaire. Review of questionnaires shows that nearly all of the students approve of the open-book examinations and nearly all say that grading practices have been fair. Many students comment that the open-book examination, by forcing them to try to think, has greatly enhanced their appreciation of their general college environment as well as their geological environment. Perhaps, surprisingly, the comments differ little whether the student earns a final grade of C or A.

DISADVANTAGES

From the instructor's point of view one of the greatest problems with the open-book examination is the difficulty in organizing good questions which cannot easily be misinterpreted. A good set of questions cannot be drawn in a few minutes; it often takes hours. A complication has been added at Santa Barbara by consistently making copies of old examinations available in the college library. Because examinations are mimeographed and each student is allowed to keep his copy, many additional unofficial files are kept by fraternities, sororities and other campus living groups. Files of other examinations are obtained even when access

*It is the practice to assign grades on an absolute rather than a curve basis, since attainment is based on an individual quality of the student; namely, reasoning and thinking power. Grades tend to be very low (up to 80% D's and F's) on initial examinations. The grade scale commonly employed is A = 90% plus; B = 80-89; C = 65-79; D = 60-64; F = 59 or less. Improvement is a major consideration in assigning grades. Though no formal pattern is established in classes at the University of California, Santa Barbara College, in practice in geology classes five one-hour examinations and a final examination of three hours are administered. Two examinations occur prior to the mid-semester report of grades, and three and a final examination in the last half of the term. Emphasis in final grade assignments is on the last four examinations, with the final examination credited at 2 or 3. Thus, 5 or 6 records in the last half of the semester against two in the first half, provide a fair basis of appraising improvement.

is not given.* Fortunately, there seems to be no limit to the number of questions which can be devised nor any limit to the number of variations, confusing only to the unprepared, which may be developed on a single theme.

Grading cannot very well be objective (if any grading truly is!) when the essay answer is used, and students are apprised of this fact at the first class session. A group of essentially similar anwers to a question, expressed in a host of different ways, cannot be graded with uniformity. This is true whether the papers are read by the instructor or a reader. Often the grade assigned on a particular answer will depend upon the student's accuracy in expressing himself. It is the practice to insist that he say what he means with accuracy to receive credit; interpretations of meaning are not made by the instructor or his readers. It is believed, without supporting statistical data, that variations in grading resulting from these practices will tend to equalize themselves over a semester in which five one-hour examinations and a two- or three-hour final are given.

On open-book examinations with essay answers there is frequently the possibility that several different answers or lines of reasoning will satisfy the conditions of a single question. When an instructor reads his own papers this problem is minimized, but when a reader is involved, with inevitably less background than the instructor, some cases of unfair grading result and have to be adjusted on an individual basis.**

The failures on the first few examinations should be interviewed personally by the instructor if the system is to be understood by the student, and bring maximal results. This demands considerable office time for instructorial conference. The writers have used the system of individual conferences for all students earning less than a C grade in any examination. In a class of 80 students, conferences may use all of the instructor's free time for a week following the return of a set of examinations. Fortunately, the percentage of failing grades steadily decreases through the semester even though the arbitrary grading standard is maintained.

The student conferences have been revealing of student reaction to the open-book examination. Students oriented toward memorization of textbook and lecture materials (and this seems to include most freshmen and sophomores in this college of a State University) are apt to fail or do poorly on the first examination because they are almost incapable of abandoning a system which has seen them through other courses with satisfactory or at least passing grades.

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*In a large class it is standard practice for members of the same organization to memorize a large number of questions by assigning 5 each to 20 members, to be written down at once on leaving the examination room in order to provide a file record for fraternity and other posterity. This is especially the case where professors give the same "standardized" examinations, choosing from sample sets.

** Instructors adopting this examination plan will find necessary much more liberality with office hours for student conference than is often customary. At Santa Barbara, in addition, staff members review all papers when requested to do so by the student, not permitting review by readers, even when readers are employed in the grading. Santa Barbara class sizes where these techniques are used, are today as large as 90. The system was employed at U.C.L.A. in classes as large as 170.

They cling to the traditional pattern of memorization even when warned repeatedly that it will bring failure. After the first examination, some see that a change is necessary, but others resolutely refuse to change, believing their failure due to the instructor's arbitrary grading standard and in no measure to their own limitations. After each examination there are fewer dissenters until practically all have "reformed". There are, of course, some who fail the course, but they are usually students who are not doing any work or who have outside problems unrelated to the classwork. Some drop the course with penalty of "F" rather than master a new technique.

Most of the better students quickly make the necessary adjustments and improve their class standing rapidly. A few students, seldom more than 5%, do well from the start because they find in the open-book examination something they had expected from a college experience.

The bulk of student difficulties, other than those due plainly to a lack of study, are caused by one or more of the following: (1) Excessive note-taking during lectures which prevents any thoughtful consideration of what the instructor is saying. (2) An almost resolute refusal to think or reason. (3) A strong tendency to devote too much time to a search of reference materials for an answer. This often convinces the student that the tests are too long or too difficult or both. (4) Frequent failure to answer the question asked on the examination, largely due to inaccurate reading habits. Judging from the written answers students give, they must scan the question and pick out a "key word" or two and immediately write everything they know or can look up about the "word". Thus, a student asked to explain why most beach sands are composed largely of quartz grains may take two bluebook pages to expound, in exhausting detail, what quartz *is*. (5) Unwillingness to participate in class discussion of questions of a searching variety raised from the floor during lectures. This technique is encouraged as a necessary part of the examination system.

CONCLUSION

Perhaps one of the best recommendations for this type of examination is the determination to continue its use after more than 15 years despite a predictably large number of student conference hours required. The end result is worth the effort, however, as shown by the student questionnaires, conversation with former students, and by the large numbers of non-geologists who elect additional geology courses. In both general and specialized education, the fruits of the harvest are worth the cost.

BLOCK DIAGRAMS FROM PERSPECTIVE GRIDS

G. F. ADAMS

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ABSTRACT. A method for constructing block diagram outlines in three dimensional perspective is developed from the "Canadian Grid" method of mapping from oblique aerial photographs. The dimensions of two perspective grids, forming the top and bottom of the block outline, are computed trigonometrically. The perspective grids based on these dimensions are assembled to form a templet from which various block outlines may be produced on overlays. The location of the point of view can also be established.

Introduction

The writer has long felt the need for a more orderly and quantitative approach to the problem of block diagram construction. The basic problem is the construction of a geometric block in perspective which may serve as the framework for the geological elements to be illustrated. The present paper deals mainly with the construction of such blocks.

Lobeck (1), in his excellent book on "Block Diagrams", deals qualitatively with this subject in his chapters on one-point and two-point perspective. No attempt is made to introduce quantitative aspects of perspective. For example, in the so-called two-point perspective, diagonals to the observer vanish at two points on the horizon. The location of these vanishing points on the horizon is indeterminate as is the orientation of the diagonals with respect to the observer. It is also tacitly assumed that vertical lines in perspective are parallel and appear as vertical lines in the block. Finally, where a map is transformed into a block, the location of the point in space from which the area is viewed is indeterminate.

A more quantitative approach has been offered by Secrist (2), who suggests that block diagrams should be accompanied by the following data: 1) the coordinates of the observer's eye, 2) the angle made by one of the receding edges of the block with the perspective plane, and 3) the dimensions of the block. Secrist computes these elements by a trigonometric method.

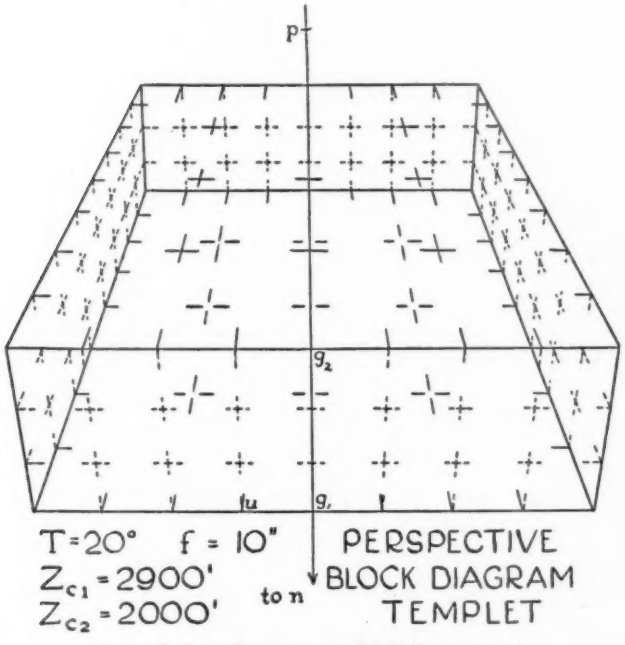
The writer agrees that these are important elements and should be expressed. Two other important elements have been overlooked by Secrist. First, the angle of view downward from the horizontal should be known. Second, if the block is to be in true perspective and is seen below eye level, all vertical lines must converge at the nadir. Secrist's statement that "the perspective of the vertical lines is always vertical" must be viewed as a simplifying assumption.

This paper presents a method of drawing true perspective blocks based on quantitative perspective principles. Instead of making a set of trigonometric computations every time a block is needed, a small group of templets may be constructed from which perspective blocks are produced on overlays. The writer has found, that, for most purposes, a single templet is sufficient. The perspective principles are not new and the method is adapted from a photogrammetric technique.

GENERAL METHOD OF TEMPLET CONSTRUCTION

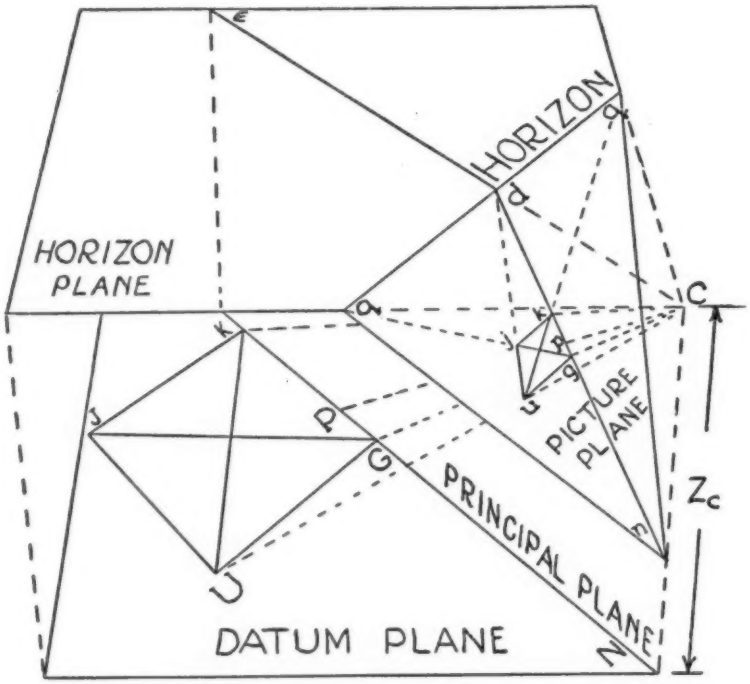
In constructing planimetric maps from oblique air photographs, the so-called "Canadian Grid" method has been frequently used, where a perspective grid is constructed from camera constants and photo data (3). The perspective grid is used to transfer key points from the photo to a square grid to make the map. This method works best when points on the ground lie close to the datum of the grid.

The method of block construction here described assumes that a fictitious camera with an assumed focal length and tilt "photographs" two perspective grids at two datum levels, the top and the bottom of the block. Actually, the two grids are constructed from computations and registered to the same horizon and principal lines. Corresponding grid corners are connected to form verticals. In the example given (Fig. 1) the verticals show considerable convergence toward the nadir. The block boundaries and faces carry ticks to indicate unit grid squares. These are used as reference points when blocks of various sizes, shapes, and orientations are drawn on overlay paper.



CONSTRUCTION OF THE GRIDS

The grid construction requires the computation of certain linear quantities by applying the principles of perspective to the assumed camera position. These quantities are laid off along two lines: 1) the horizon, and 2) the perpendicular to it passing through the center of the "photograph", the principal point, p. This is the principal line. Figure 2 is a block diagram, constructed by the method here described, showing the perspective elements with respect to a single ground datum plane. Upper case letters are used to designate points on the ground datum plane, the "camera" position (C) and its height above the datum (Z_c). Lower case letters designate points on the picture plane. The line qq is the horizon and dp is the principal line. Lines UK and JG on the datum, trending 45° to the line of sight (Cd), become plate diagonals uk and jg in the picture plane. Lines uk and jg vanish at the q points. Lines UJ and GK on the datum, parallel to the line of sight (Cd), become plate meridians uj and gk in the picture plane and vanish at d. Lines UG and JK on the datum, parallel to the horizon, become plate parallels, ug and jk, in the picture plane and remain parallel to the horizon. A unit distance (ug) along the plate parallel will bear a fixed ratio to the ground distance (UG), determined by the location of g.



To make the necessary computations, we assume the following: (Figs. 2, 3)

Z_{c1} = height of "camera" station above lower datum

Z_{c2} = height of "camera" station above upper datum

T = angle of tilt of "camera" axis down from horizon

f = focal length of "camera".

From the geometry of perspective, the following relationships can be demonstrated: (Figs. 2, 3)

(1). dp = f tan T = distance from principal point (p) to horizon

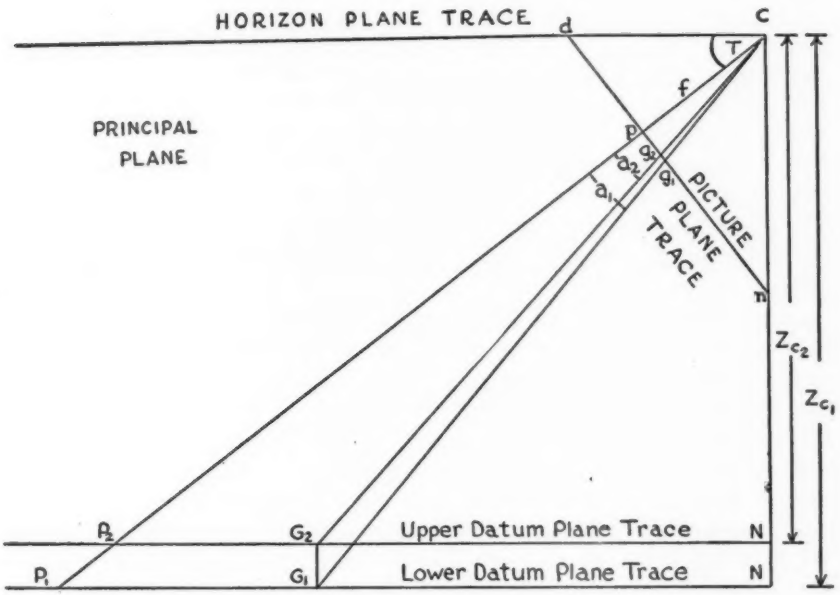
(2). dq = dC = f/cos T = distance from d to vanishing point of plate diagonals

(3). pn = f/tan T = distance from p to nadir (n)

(4). $dg_1 = Z_{c1}/$ (A cos T) = distance from d to plate parallel through g, where scale is 1 inch = A feet.

Note: no other plate parallel will have this scale.

These are the basic constants for the lower grid. Since dp, dq, and pn depend only on the focal length and tilt, they are the same for the upper grid. The value dg_2, for the upper grid must be computed as indicated below since it depends partly on the height of the camera station above the datum.



PROCEDURE FOR GRID CONSTRUCTION

1. Select a sheet of drawing paper whose dimensions are at least (2dq +1) by (dg + 2) inches.
2. Draw horizon parallel and close to top edge of long dimension.
3. From middle of horizon erect perpendicular, and label intersection, d.
4. Lay off dq right and left from d.
5. Lay off dg down from d.
6. Lay off dp down from d.
7. Draw a line through g parallel to the horizon.
8. On line through g, lay off appropriate distances (ug) for scale selected. (On lower grid of Figure 1, ug was 1 inch before reduction)
9. Connect these divisions with one q point and with d, to make plate diagonals and plate meridians.
10. At the intersections made by the two families of lines, construct the plate parallels. The second set of plate diagonals may be drawn to test the accuracy of the drafting. The completed grid omits both sets of plate diagonals showing only plate meridians and plate parallels (Fig. 1).
11. Number grid lines and indicate Z_c, T, and f.

Data for the lower grid shown in Figure 1, using a tilt of 20° and a focal length of 10 inches, are given below:

Z_c	dp	dq	dg	pn
2900′	3.64″	10.64″	10.21″ (where A = 300′)	27.47″

For the upper grid, the value dg_2 is computed as follows: From Figure 3, the following relationships can be demonstrated:

(5). $\tan a_1 = pg_1/f$; solve for a_1
(6). $\cot (T+a_2) = \cot (T+a_1)\ Z_{c1}/Z_{c2}$; solve for a_2
(7). $pg_2 = f \tan a_2$; solve for pg_2
(8). $dp + pg_2 = dg_2$

To fix the scale along the plate parallel through g_2:

Since dg_1 was computed to fix the unique position of a plate parallel whose scale was 1 inch = A feet, it follows that the scale of the plate parallel through g_2 must be different. This scale may be computed so that 1 inch = X feet. Using the computed value of X, the distance along the plate parallel, ug, corresponding to A feet may be also computed.

To compute the scale through g_2 where 1 inch = X feet, use equation (4), substituting the new factors:

(9). $dg_2 = Z_{c2}/(X \cos T)$ and
(10). $X = Z_{c2}/ (dg_2 \cos T)$. Solve for X.

To find the distance along a plate parallel (ug_2) corresponding to A feet, use the proportion

(11). $1/ug_2 = X/A$ or $ug_2 = A/X$

Units of ug_2 inches are laid off on the plate parallel through g_2 and the second grid can be completed.

Assembling the Grids Into a Templet.

A piece of tracing paper is laid over the lower grid and the horizon and principal line are traced. The q points are marked to complete the registry elements. The desired portion of the grid is traced to form an outline for the base of the block. The writer used a square (Fig. 1) which would be called one-point perspective by Lobeck but which includes two-point perspective if the plate diagonals are used. Such squares are adequately described as being in perspective. Ticks for unit squares are added on the four sides and for alternate squares on the face area.

The lower grid is replaced by the upper and carefully registered with the horizon and principal line. A corresponding area is traced to form an outline for the upper limit of the block. Appropriate ticks, but of different pattern are added.

The grid corners are now joined by straight lines to complete the block outline. Note that these lines converge downward. At this point a check on the accuracy of the work can be made by extending the converging verticals to the principal line. If they meet on the line and at the point n (measured as pn from p), both the computations and the drafting may be considered satisfactory.

After this check has been made, ticks are added to the vertical face. In order to complete this, the front face of the block must show intermediate levels of A feet. This is accomplished by computing intermediate values of dg, using equations 5 - 8, and appropriate Z_c values. For the example cited (Fig. 1), these are 2300 and 2600 feet. After locating the new plate parallels through the new g points, their block corner intersections are extended in perspective to d, thus carrying the intermediate levels to the rear of the block. With these lines and the ticks on the top and bottom of the block, vertical face intersections may be marked off, using a distinctive pattern. In this way, unit cubes are developed.

All six faces of the block are now gridded and the block is ready to be transferred to more durable material for use as a templet. The templet should show the following data: T, f, Z_{c1}, Z_{c2} and the size of the cubic sub-blocks. It is then ready for use. The following data were used for the templet here presented (Fig. 1):

$T = 20°$, $f = 10$ inches, $Z_{c1} = 2900$ feet, $Z_{c2} = 2000$ feet.

Unit cubes represent 300 feet on a side.

Other templets may be constructed by varying Z_c, f, and T. Varying the Z_c values changes the depth of the block and its scale. The same end may be accomplished with an existing templet by computing additional dg values for increasing the depth and by enlargement or reduction to vary the scale. For example, figure 1 was reduced in order to accommodate it to the page size of the Journal.

The focal length should not vary greatly since it should be about the distance a picture is held from the eye for normal viewing.

The tilt, T, is the most important variable, and the user may wish to construct several templets with different values of tilt.

A final variation may be introduced by inverting the grid elements to permit illustration of views seen from below. This would seem to have limited application such as looking up from the floor of a cave toward the roof.

ADJUSTING THE BLOCK AND CAMERA STATION FOR SCALE AND RELIEF

When the block is to show a specific map area, the scale of the block must be adjusted to the map area and its relief. Before adjustments are made, the map area should be outlined and oriented to get the desired direction of view. The ground projectection of the principal line (PGN of Fig. 2) should be the center line of the map area. It is drawn parallel to the direction of view and extended toward the viewer so that N, the computed ground point of the "camera" station may be marked on the map.

If the vertical and horizontal scales of the block are to be identical, the maximum area covered by the block will be controlled by the ratio of the maximum relief (H) to the number of vertical unit squares assigned to relief in the block (n). Since the templet has 8 scale units in each direction, the maximum map area that can be shown is 8 H/n feet on a side. If this is not large enough to show the desired area, the scale must be further reduced. Such scale reductions may require the introduction of vertical exaggeration to emphasize relief. This produces the usual slope distortions and should be avoided where possible.

Uniform reduction of vertical and horizontal scale implies that the "camera" is shifted to a higher and more distant position than the one originally assumed. The new position is computed as follows:

(13). $Z_{cR} = dg_1 \ R \cos T$, where Z_{cR} is the new height of the "camera" station above the lower datum of the block and R is the scale dimension of the cubic sub-blocks.

To locate the "camera" position on the topographic map from which the block diagram is derived, the distance GN (Fig. 3) is computed by:

(14). $G_1N = Z_{c1} \ (T + a_1)$.

If a new scale has been selected, Z_{cR} (equation 13) is substituted for Z_{c1}.

TRANSFERRING MAP FEATURES TO THE BLOCK DIAGRAM

The first step is to construct a square grid on the map area. The grid intervals should represent the same length (to the scale of the map) as the sides of the unit blocks of the templet. Numbering the square grid to correspond to numbers on the templet will assist in transferring points from the map to the block.

The procedure from this point may be varied, The writer has found it useful to construct profiles on the four sides of the block as a framework. Stream and ridge lines may also be plotted by estimating positions of points from the nearest grid ticks. Slope lines may be "hung" on this framework. This is partly an artistic matter which falls beyond the scope of this paper but due regard must be retained for the actual slopes as they appear in perspective.

Block Layouts From the Templet

Blocks of various sizes, shapes, and orientations may be easily developed on transparent paper taped to the templet by selecting appropriate points to produce rectangular or triangular forms. Appropriate grid ticks of unit cubes should be transferred to the block form selected.

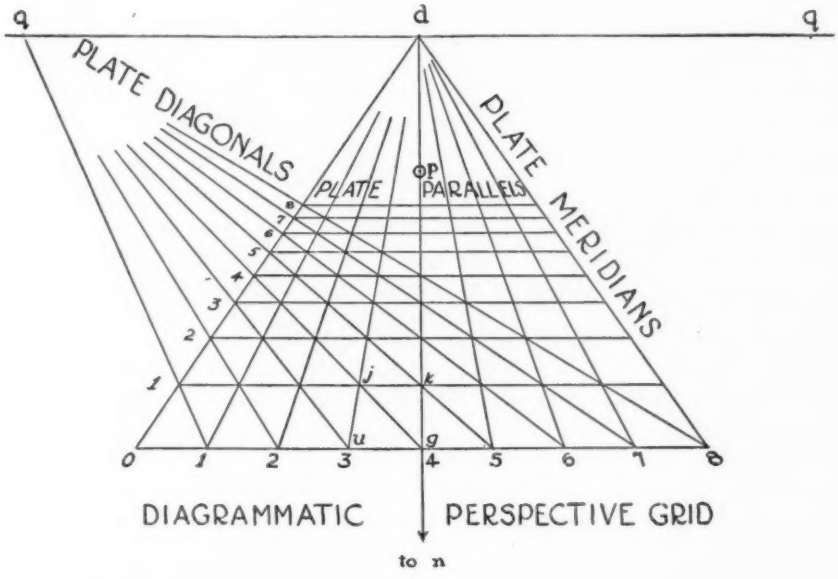
Two basic orientations are possible. The first uses plate meridians and parallels, the second uses plate diagonals. Intermediate orientations may be set up by using unit ticks in front and side proportions of 2:1, 3:1, etc.

The size of the block may also be varied to include part or all of the templet dimensions, both horizontal and vertical.

Whatever size or orientation is used, the block gives a more pleasing effect if it is centered about the principal line (pn of Fig. 1). The block also gives a better visual effect if the whole block can be seen without shifting the eyes.

General Advantages of the Method are;

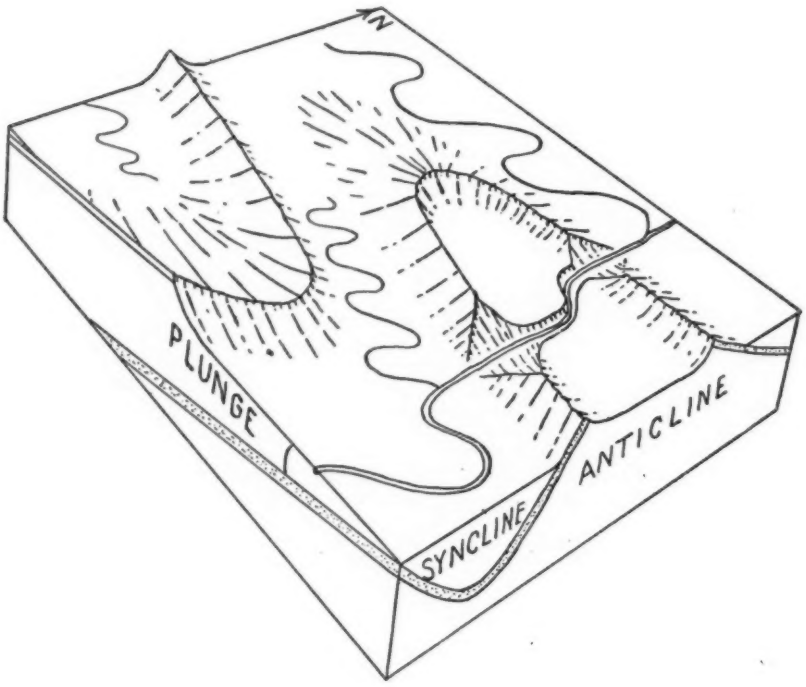
1. Blocks are easy to outline after a little practice with the templet.
2. Blocks are in true perspective.
3. Scales are available in three dimensions.
4. Orientation of the block sides with respect to the observer are established.
5. The point of view can be located. In blocks drawn from maps, the point of view can be located on the map and its altitude above the datum determined. Conversely it should be possible to show how a mapped area would look from a specific mountain top or other vantage point. This might require production of additional templets.



Specific Uses for the Method are;

1. To illustrate this paper (Figs. 1 and 2)
2. To illustrate geologic structures.
3. To show the relation between structure and topography.
4. To make block diagrams of specific areas.
5. To make regional geomorphic diagrams to show broad relations.

For many of these uses, the upper surface of the block involves the representation of topography. This is partly an artistic matter since it involves representation of changing slopes and curving horizontals. When adding slope lines, it should be remembered that vertical lines in nature are seldom vertical in the block, i.e., parallel to the edge of the paper. The true position of the vertical may be estimated by reference to the nearest vertical grid ticks. This applies not only to surface slopes but to those of linear elements of geologic structure shown on the block sides. In drawing curved horizontals, it should be recalled that horizontal circles foreshorten into ellipses whose major axes lie along plate parallels. A final artistic matter relates to lettering the block. Full advantage should be taken of the true perspective to make the lettering seem to lie in a particular plane (Fig. 5).



Conclusion

The author hopes that the method described may be of real value to users of block diagrams. A limited number of full-scale templets, from which the reduced scale block of Figure 1 was produced, are available from the author on request.

Works to Which Reference Is Made

1. Lobeck, A. K. 1924 "Block Diagrams" John Wiley
2. Secrist, Mark H. 1936 "Perspective Block Diagrams" Econ. Geol. Vol. 31, p 867-880
3. Canadian Topographical Survey, 1932 "The Use of Aerial Photographs for Mapping" Canada Dept. of the Interior, Topog. Bull. No. 62 p 12-31.

VISUAL AIDS FOR ELEMENTARY HISTORICAL GEOLOGY

Color slides are widely used in teaching elementary geology. Making slides for physical features is relatively easy; it reduces itself to thinking of taking the right feature when in the field. Slides of extinct animals are another matter. For these we must rely on paintings, many of which have not so far been reproduced in color by the institutions that own them.

Fortunately, such sets as those issued by the Hughes Tool Company are ideal for this purpose. Attention has been called elsewhere to the 60 plates in "Prehistoric Animals" by J. Augusta and Z. Burian which are also excellent for this purpose. Life Magazine and the National Geographic Magazine have also published fine color reproductions from time to time. Life Magazine has also prepared several film strips which can be used in the classroom. Color reproductions may be used on bulletin boards or may be framed and hung on classroom walls. Their usefulness can be enhanced by making copies on 35-mm. Artificial Light Kodachrome. Slides prepared in this manner turn out very well providing some care is used in focussing exactly. The task is much easier with a single-lens reflex camera than with other types of cameras. A copying stand, two photofloods in reflectors, and a few extension tubes for the smaller pictures are all that is necessary to make these color reproductions. Even with large magnifications, up to 4 x 4 feet the colors are crisp and clear in projection.

The obvious advantage of individual slides over film strips is that the slides can be arranged in any desired order and the subtitles for the frames of the film strip need not be used. Numerous such slides are now in use in the department of geology of the Ohio State University. This note is to call attention to the ease with which they can be prepared.

FIRST SUMMER INSTITUTE IN GEOLOGY, 1957

D. M. HENDERSON and A. F. HAGNER
University of Illinois

The First Summer Institute in Geology for College Teachers, sponsored by the National Science Foundation, was held at the University of Illinois from June 17 to August 10. The Institute was conducted by D. M. Henderson and A. F. Hagner, Co-directors, and by R. M. Garrels of Harvard. Twenty-six teachers of geology in colleges throughout the country attended.

The theme of the Institute was *Geologic Frontiers*. The program centered around the application of knowledge about the nature and behavior of the mineral phases to many different kinds of geologic situations. The purpose was to assist teachers to: modernize their approach to geology, attract more creative students into the field, and stimulate and prepare students more effectively for advanced work.

During the first four weeks, a background was laid by the Institute staff and by lecturers from the University and State Geological Survey. Morning lectures and discussions were devoted primarily to an introduction to the principles of atomic structure and behavior of minerals and to geochemistry. Afternoons were devoted to work in the laboratory on crystallography, crystal structure, X-ray diffraction, Eh-pH measurement and interpretation, and to demonstrations of electron microscopy and diffraction, and of optical, X-ray and mass spectrography.

During the second four weeks, thirteen eminent geologists discussed their research as examples of the problems they face, their mental approaches to these problems and their methods of attack. The interdependence of field, experimental, theoretical, statistical, petrographic, chemical and nuclear approaches was discussed and their advantages and limitations as ways of interpreting natural phenomena were evaluated.

The last half of the program was also devoted to individual short research problems and to discussion of them. Many of the participants began research that they expect to continue in the future.

During evenings, many participants took part in informal seminars on the problems of undergraduate teaching and research. Many also constructed atomic models and other teaching aids.

One outgrowth of the Institute program is the plan to publish the talks of the invited lecturers. This should be of great interest to teachers of geology because it will make the work being done at the frontiers of geology easily available to them and to their students.

The participants were enthusiastic in their belief that the Institute: 1) stimulated new outlooks on geologic research, 2) gave them the opportunity to engage in it, 3) encouraged new directions in teaching and the exchange of ideas on teaching, 4) provided them with an opportunity to acquire and synthesize the

results of new contributions to geology, and 5) the opportunity to discuss such problems among themselves and with outstanding contributors to geology.

The National Science Foundation made such a rewarding experience possible by granting a stipend of $600, an allowance of $120 for each dependent and a travel allowance up to $80 for each participant, as well as underwriting the other costs of the Institute.

A WORD FROM THE EDITOR

Your attention is called to the minutes of the Eastern and East Central sections, published in this issue. Each of these sections made a substantial contribution from its treasury to alleviate the financial plight of the JOURNAL. In order to print more of the excellent manuscripts that reach the editor's desk, and to use those manuscripts requiring illustrations, the JOURNAL'S budget must be increased. Your editor wishes to express most sincere thanks for help received, both from individuals and from the sections. A long range policy needs to be considered, however, to put the JOURNAL on a firm fiscal basis.

A NEW DEGREE AT MCGILL UNIVERSITY

The Department of Geological Sciences is offering a new two-year sequence of courses leading to a degree of Master of Science (Applied) in Mineral Exploration. The new degree is designed to provide advanced professional training. New discoveries and techniques in Geology, Mining, Metallurgy, Physics, and Chemistry have made this new sequence desirable in order to provide adequate training for students entering the mineral exploration field. The various Departments concerned with these subjects are co-operating in teaching the new courses. The legal and financial aspects of Mineral Exploration are also touched upon.

Mineral production is at a new high. With a constantly rising demand for metals and minerals, it is apparent that Mineral Exploration is becoming increasingly important. The new technical methods of exploration that have recently been developed require more basic training than can be given in undergraduate work.

The new Mineral Exploration course at McGill University may be approached either from the Bachelor's degree in Mining Engineering or from the B.Sc. degree with Honours in Geology. Students who complete the M.Sc. (Applied) sequence with high standing may continue towards the normal Ph.D. (Geology) degree.

ILLUSTRATION OF PERIODIC PROPERTIES

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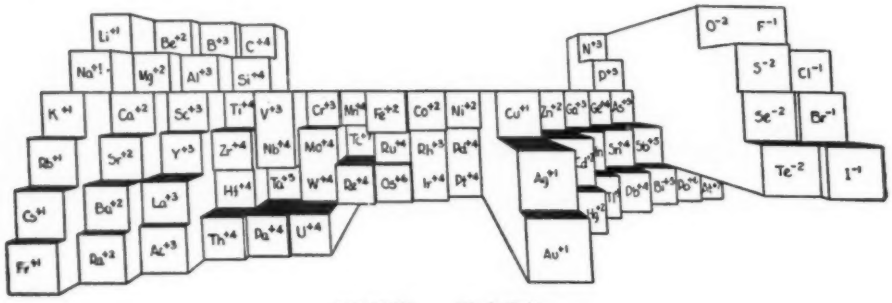
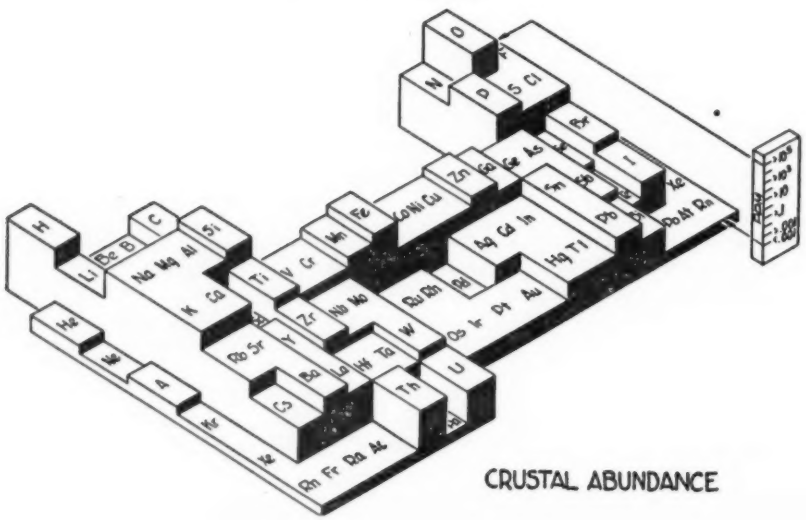
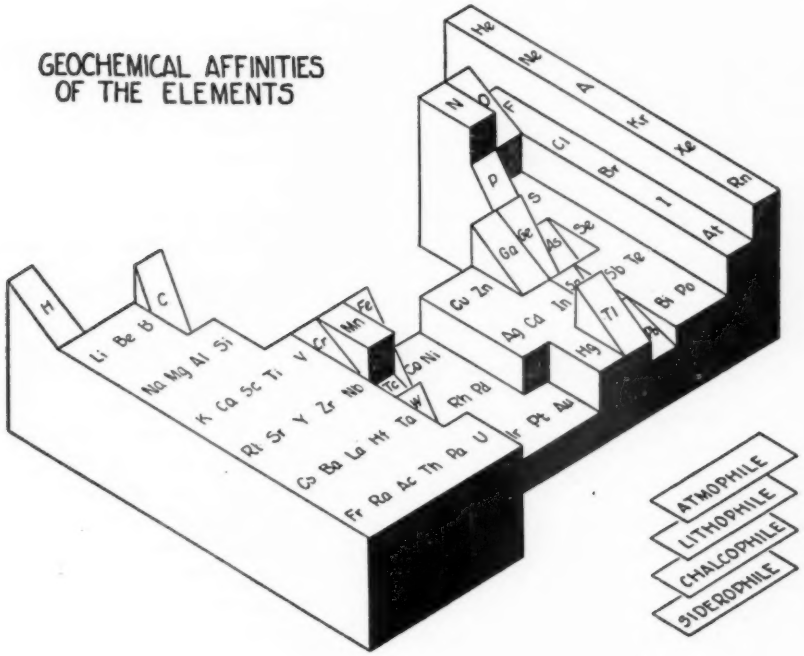
Massachusetts Institute of Technology

A periodic table as usually drawn is a two dimensional diagram relating the electronic configurations of the elements. Chemical similarities and differences, which are the result of the different electronic arrangements, are readily determined from the position of an element in the table. Many periodic properties of interest to the geochemist are, however, not easily seen by inspection of a two-dimensional periodic table. Such properties may be shown by the addition of a third dimension. A number of periodic properties of the elements may then be correlated by inspection.

Figures 1 to 4 are samples of the manner in which various properties of elements may be presented by appropriate projections. A ready grasp of the periodic variations is afforded, and elements with contrasting or similar properties can be easily found.



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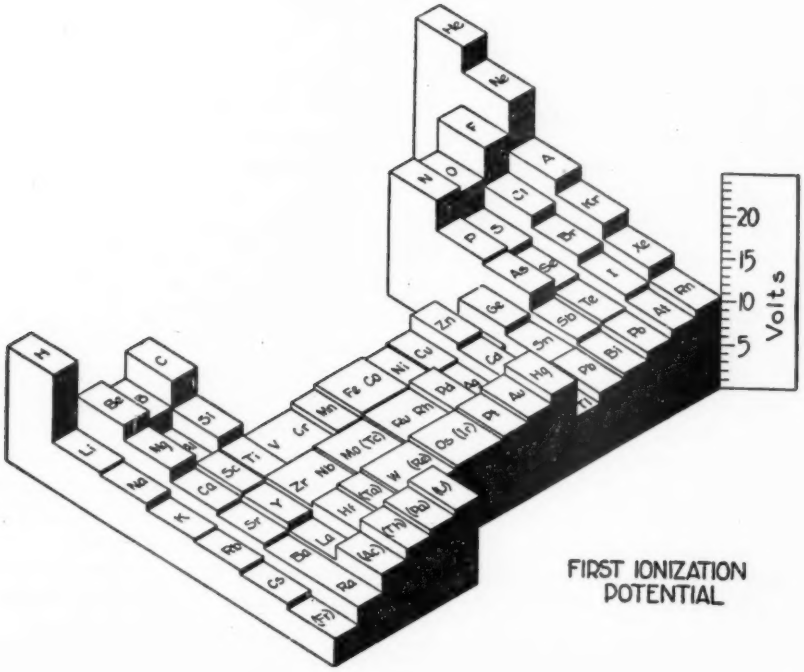
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A TEMPLATE FOR DEMONSTRATION OF THE "THREE-POINT PROBLEM" IN TRIANGULATION RESECTION

RICHARD L. THREET
University of Utah

ABSTRACT. A "great triangle—great circle—instrument station" network is constructed on a cardboard sheet and then traced onto a frosted acetate sheet which can be rotated to simulate misorientation of the plane table. Resection rays drawn on the acetate sheet, parallel to corresponding rays indicated on the underlying cardboard, intersect to form a triangle of error with respect to the point sought. Conversely, if a given "triangle of error" construction is drawn on the cardboard sheet, the acetate sheet can be rotated into the proper orientation to cause the indicated "lines of sight" to intersect at a common point which represents the proper location of the "instrument station".

While students may gain some familiarity with the "three-point problem" in plane table resection and may find that the tracing paper method or Lehmann's method (Low, 1952, pp. 83-84) gives generally satisfactory solutions, it may be desirable to offer some understanding of the geometry of the triangle of error formed by resection rays when the map is incorrectly oriented. The accompanying illustration shows the elements of construction and use of a simple dial and transparent template which simulate actual conditions on the plane table sheet. A large version of the device may be mounted on a plane table board for realistic demonstration in the classroom; small models may be constructed for desk use and experimentation by individual students.

The device consists of two parts:

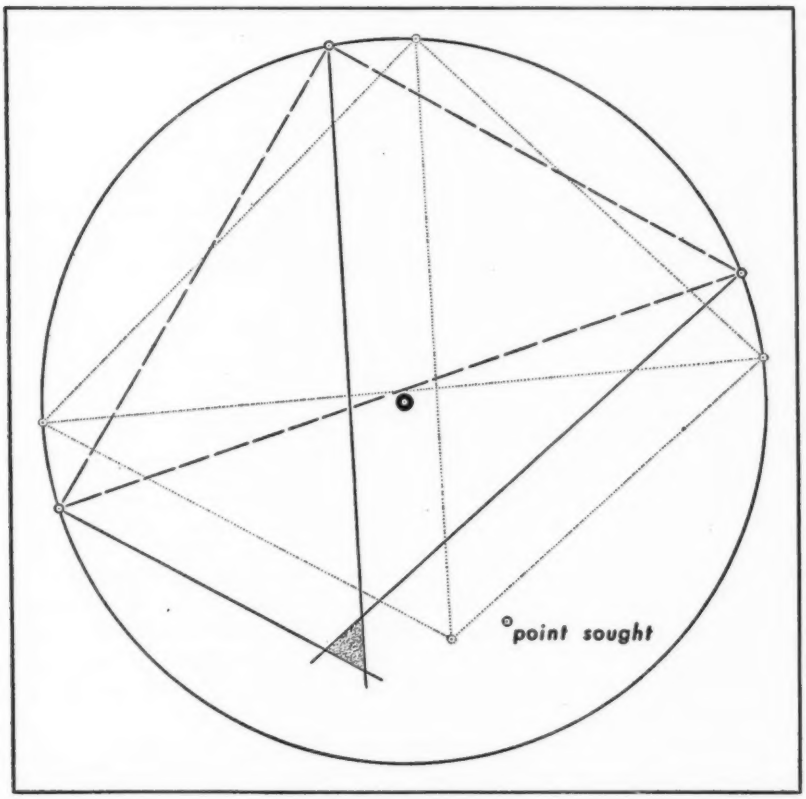
(1) a stiff cardboard sheet on which three control points or "flags" have been marked in arbitrary positions; a "great triangle" has been drawn by joining the control points with straight lines; a "great circle" has been constructed to circumscribe the "great triangle"; and several other points, representing instrument stations, have been plotted at various places within and without the "great triangle" and "great circle".

(2) a sheet of frosted acetate or other tracing medium which has been riveted or thumbtacked to rotate about the center of the "great circle" (or any other point on the cardboard sheet, for that matter), with all the "flags" and "instrument stations" then traced in their respective positions.

When the points on the acetate sheet are registered over their counterparts on the cardboard, the acetate "plane table sheet" is "correctly oriented", of course. If the acetate sheet is rotated through several degrees and resection rays are then drawn through the respective "flags" on the acetate sheet, parallel to the corresponding "flag—instrument" lines of sight indicated on the underlying cardboard, a triangle of error results from incorrect orientation of the "plane table sheet". In a sense, this procedure amounts to working the "three-point problem" in reverse, but the device has the advantage of demonstrating graphically the effects of a given degree of misorientation on size and position of the triangle of error, in relation to location of the point sought. This method of illus-

tration also permits graphic verification of the numerous rules which are listed in most surveying textbooks that treat solutions of the "three-point problem".

If it is desirable to use a similar template device for solution rather than demonstration of the "three-point problem", the "triangle of error" construction can be done on the cardboard sheet. with a corresponding "great triangle—great circle" traced on the acetate sheet. By proper rotation of the acetate "plane table sheet" and construction of parallels to the indicated "lines of sight", the resection rays can be made to intersect in a common point to determine the location of the "instrument station" and correct orientation of the "plane table".



REFERENCE CITED

Low, J. W., 1952, Plane Table Mapping: New York, Harper & Brothers.

FIGURE 1.—Diagram of template device, showing construction of triangle of error in relation to point sought by resection. Faintly dotted lines and points represent proper positions and rays shown on cardboard fixed portion of device; heavy lines and points represent apparent positions and rays constructed on transparent plastic movable template which has been rotated out of orientation. Triangle of error due to misorientation is shaded, and position of point sought is indicated.

GEOLOGICAL EDUCATION IN NORWAY

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Lectures in Geology (here used in the usual broad American sense to include Physical, Historical, and Structural Geology, Geomorphology, Mineralogy, etc.) are offered in all four of the centers of higher education in Norway, Oslo and Bergen universities, the Technical "High School" at Trondheim, and the Agricultural "High School" at Ås. However, until fairly recently, it has been possible to take a degree in Geology only at Oslo University, the eminence of which in geological fields is indicated by the fact that the names of many of its former and present faculty and students are "household" words in geological circles the world over.

It is now possible to take degrees in Geology at Bergen University, created from the Bergen Museum as a fully accredited university in 1948. At Ås and Trondheim, however, lectures in Geology are offered only in connection with the training of agricultural and engineering students, although these people can, if sufficiently prepared, take examinations, and hence a degree, at Oslo or Bergen without attending either school.

In order to appreciate the scope and level of instruction in Geology in Norway, it is first necessary to understand something of the position of the university in the educational heirarchy, the previous training of its students, and the local demands of the profession for which they are trained. Unfortunately, it is quite imposible to draw direct comparisons between Norwegian and American universities, for the structure of the educational system on all levels is greatly different in the two countries. The Norwegian university is concerned entirely with academic teaching, and does not consider the general, spiritual, or physical education of the student a part of its primary task. Presumably, a broad, "liberal" education has been acquired in the gymnasium before the age of 19, and this is therefore not the concern of the university. At least roughly, one can say that the Norwegian gymnasium is equivalent to 3 years of American high school plus the first year or so of college, and, at least in some cases, gymnasium graduates are admitted as Juniors in American universities, even though they are about a year younger than their American classmates.

At the end of a gymnasium course, most students take rigorous "Artium" examinations, somewhat like the New York "Regents", in the particular line they have chosen. The successful completion of these is necessary for matriculation at the university. Most of those who pass the "Artium"—by no means all Norwegian students—matriculate at, and become members of the university, even though they may have no intention of pursuing a degree program there. There is a small initial fee for this, but after it is paid, and with the exception of small laboratory and examination fees, the balance of the education is free, and a matriculated student may attend lectures whenever and for however long a time he wishes.

Oslo University has several "degree programs", but only one of these is of particular importance to students in Geology. This program leads to the degree "Candidatus realium", very broadly equivalent to the American "Master of Science". For the Cand. real., a student must prepare for both written and oral examinations in at least 3 subjects (e.g., these might be Mineralogy, Paleontology, and Chemistry). These are "bifags" or minors. Together with all others in the university, he must take an obligatory examination in Philosophy and Psychology, and, if it is not one of his bifag subjects, an additional examination in Mathematics. After the bifags are completed (about 5 years of study) the student may use the title "Candidatus magisterium", which, probably inappropriately, might be equated loosely to the American Bachelor of Science. Then, he generally chooses to pursue one of his three bifag subjects as a "hovedfag", or major. To do so, he attends further lectures, does additional reading, and prepares a thesis, which may cover either a basic research problem or a topic assigned by the faculty. Furthermore, he must stand another oral examination in this subject, given by members of the faculty concerned. Such a program, with three "bifags", one expanded to a "hovedfag", leads, in 6 - 7 years, to the "Candidatus realium".

The bulk of university teaching, therefore, aims to prepare the students for final examinations (embetseksamen) within their various bifags. There is, for this reason, no system of credits and no normal time-schedule or fixed program of degree courses. Except in a few cases (mostly laboratories) students are not bound to attend university lectures and classes or to submit written reports or papers, and in only a few programs (i.e. Medicine) are there compulsory courses which must be taken before a student can present himself for examination. The principle followed is that a student's ability is tested at the examination and it is his business how he acquires the knowledge. Naturally, he may always request and receive advice, but there is no system of formal counseling or scheduling.

In the various Institutes (Departments) which include the bifag and hovedfag subjects normally chosen by Geology students, there are, at present, no obligatory courses in the Cand. real. program, and only a few laboratories (i.e., in Mineralogy) at which attendance is required. Ordinarily, a number of field excursions are scheduled each year, and participation in these is both encouraged and expected, but not formally required. Although a student may present himself for a bifag examination without having attended a single lecture or taken part in a field trip, he can expect to be more thoroughly examined on field work than are those who have attended a majority of the field excursions. This, however, rarely happens.

The academic, and largely theoretical character of the present university philosophy, results in an omission from the schedule of lectures of essentially technological subjects like Field Methods, Mapping, Well-logging, Petroleum Geology, Mining Geology, and so forth. Lectures are broad enough to include the fundamental features of all of these, however, but are, for the most part unaccompanied by the exercises, demonstrations, and supervised practice which frequently become a large part of the American university program. The Norwegian student

is not directly instructed at the university in the techniques of field work and map interpretation (unless one of his bifags is in Geography) but most learn these through apprenticeship to an experienced field geologist during summer employment with the Geological Survey, in informal study groups, or in the field and library on his own time. However, the fact that Norwegian geologists are eminently capable in the field indicates that the lack of such practical subjects in their university education causes no particular professional hardship.

Textbooks, a matter of course in most American universities, are not commonly assigned in Norway. However, the lecturer may suggest as collateral references a number of general texts, or may provide a syllabus or printed notes in conjunction with his lectures. Students are encouraged to do extensive reading in the basic literature, and my experience suggests that they are very well acquainted with it. Moreover, an emphasis on languages in the gymnasium results in the fact that most Norwegian university students can read and generally write with remarkable skill in at least one language other than their own. Hence, in their studies, they are equipped to consult, and, for purposes of examination, can be expected to have consulted a considerably greater volume of the literature than is available to most linguistically disinclined American students.

At Oslo University, there are regular lectures offered in General Geology, Paleontology, Mineralogy, Petrology and Petrography, Geomorphology, Quaternary Geology, Tectonics, Geophysics, Sedimentology, and Norwegian Geology. Other subjects may be taken up in small groups, or seminars, or special series are scheduled by specialists in response to demand for them. In most of these subjects, there are one or two 45-minute lectures per week each semester, and laboratory work, if offered, usually takes the entire day. In addition, there are always a number of non-scheduled lectures and discussions during a semester, and student participation in the monthly meeting of the Norsk Geologisk Forening (Geological Society of Norway) is high. Furthermore, they have their own club, GAEA, which meets monthly for general lectures and discussion—rarely serious—and organizes geological field excursions during the year.

At the present time, there are about ten students at Oslo University studying for the Cand. real. in Geology, and a similar number are preparing dissertations which they plan to submit for the doctorate. It is difficult to tell how many of those who elect a bifag in one of the geological fields will prepare a hovedfag in the same field, so their number is not included. They are the "shadow majors" of American university parlance, and need not declare their intentions in advance. The present number is unusually large, and it is naturally conditioned to some extent by the demand for people with geological training. Many have, or can expect to have positions with the Norwegian Geological Survey, although both the Departments of Public Roads and State Railways employ geologists. There are a few positions from time to time with mining companies, largely for the geologically trained engineers from Trondheim, and a variety of non-academic curatorships and assistantships available in the various Institutes and Museums of the university. By and large, the latter categories are research positions, and

are filled by qualified men and women, active in research, who are preparing doctoral dissertations, or have already done so.

To many, including the writer, the freedom of the Norwegian university, its emphasis on the individual, and its lack of the formal curricular accoutrements of the American university, give it a character and elasticity both refreshing and stimulating. However, much of this character is possible because the student begins well grounded in the subjects he would be expected to learn in an American university. It should be pointed out, though, that many Norwegians feel that, without some initial direction, a course of study pursued in this way takes an unfortunately long period of time. Primarily for this reason, there is, at present, a movement in the Faculty of Natural Sciences toward the adoption of a system of basic required courses in the first two years of study. This, of course, would be a significant departure from the traditional European philosophy, but it is apparently supported by a considerable number of the Science Faculty.

It would be unfair to conclude these remarks without mentioning that there is a fine and surprisingly well-informed interest in geological subjects on the part of the "laymen" in this outdoor-minded country. The university's Geological and Paleontological Museums in Oslo and Bergen are popular with children and adults alike, and their interest is further guided by a number of nontechnical books written by members of the university faculty and available at all of the bookshops. Public field trips (organized by the museums) are attended by as many as a thousand at a time. It is not at all uncommon to see Holtedahl & Dons' excellent "Guide to the Geology of the Oslo Region" being consulted along the Nordmarka trails on weekend hikes, and a geological map of the region is in many cases as prominent as the topographic map on the wall of many ski-huts.

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A NOTEWORTHY VOLUME

A book now available in this country, "Prehistoric Animals" by J. Augusta and Z. Burian, originally published in Europe, contains 60 plates, many in color, of restorations of fossil animals from the Cambrian to the Pleistocene. The plates are particularly valuable not only for their number but because many of the subjects are different from the standard available paintings of the same nature. Marboro Books offer this fine publication at $7.95.

THE STUDY OF GEOLOGY AND MINERALOGY IN BELGIUM

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Entrance requirements to a Belgian university or institution of higher learning of university status differ considerably from those in force in similar American institutions. This results from the pattern of secondary studies: admission is not on a selective basis, at the discretion of the university, but is a right earned by anyone acquiring a certificate of secondary studies.

The Belgian high school student attends classes from 8 to 12 and from 2 to 5 four days a week; Thursday and Saturday classes are held from 8 to 12 and the afternoons are free, except in the last year. Geography which is mainly Earth Science in its presentation, with cultural and economic aspects considered as consequences of the physical aspects, is not an elective subject: it is required, during the six years of high school regardless of the future profession of the student.

Graduation from a high school is not a prerequisite to admission to a university: a student may take an examination before a Royal Commission, known as the *Jury Central,* and if satisfying the examiners be granted a certificate which has the same value and privileges as the high school certificate.

High schools offer five different curricula: Greek-Latin, Latin-Sciences, Latin-Mathematics, Sciences and Commercial. A certificate of Greek-Latin studies is required for those intending to become geologists.

Belgian Universities are subdivided in "Faculties". Geology belongs in the Faculty of Sciences. So is geography, recognized as a "natural science" rather than a "social science." Degrees offered are candidate in geological and mineralogical sciences (our baccalaureate), licenciate in geological and mineralogical sciences and doctor in geological and mineralogical sciences. Courses in geology are however not limited to the Faculty of Sciences: they are required in other Schools and Faculties: students majoring e.g. in economics, anthropology, all engineers, business administration, pharmacy, biology, commerce, political science, etc. must fulfill requirements in geography and geology to get their bachelor's degree. Attendance at an institution for higher learning is not compulsory and all degrees can be earned by passing examinations before a Royal Commission, the *Jury Central pour la Collation des Grades Académiques.* Degrees are protected by law and anyone falsely claiming possession of such a degree is passible of fines and prison terms.

A student has far greater freedom of transfer than in the United States: he can change schools at the end of any academic year and by law he cannot be compelled to repeat any course he has successfully completed. Indeed, the Belgian educational system does not function according to the "credit" system, but, as some American schools, according to the "course" principle. The law sets the minimum requirements for each degree. The University has the right to add to these requirements, but not to subtract.

The legislator has set as minimum requirements for the candidate degree the successful completion of the following subjects in not less than two years (*)

Logic, Ethics, Psychology
General physics including laboratory exercises
Elements of analytic geometry, of integral calculus and analytical mechanics (3 courses)
Elements of botany including laboratory exercises
Elements of physical geography including laboratory exercises
Elements of geology including laboratory exercises
Elements of mineralogy including laboratory exercises
Elements of zoology including laboratory exercises
Advanced botany
Advanced zoology

The law requires completion of the following subjects for the degree of licenciate and sets a minimum of two years to complete same (*):

Analytical Chemistry and Laboratory Exercises
Mineralogy
Lithology
Crystallography
Physical Geography
Geology
Stratigraphic Phytopaleontology
Stratigraphic Zoopaleontology

and advanced study in one of the elective fields: physical geography; plant and animal stratigraphic paleontology; pure geology; crystallography; mineralogy; petrography; applied geology.

A licenciate thesis is required in all cases and must be concerned with the subject chosen as the advanced study course.

The University of Louvain added to the baccalaureate curriculum an extra course in Elements of Crystallography. It also requires the licenciate to take a course in Prehistoric Archaeology and one in Meteorology and Geophysics. The Free University of Brussels added to its licenciate requirements courses in Paleogeography, in Topography, in Geophysics (optional), in Geology and Mineralogy of Belgian Congo, Climatology, advanced Geology and Economic Geology. Both Brussels and Louvain require at the Graduate level courses in Geological mapping and Field Geology.

Examinations differ also considerably from the pattern followed in American schools: they are taken twice a year and a candidate has thus two chances of passing: first in July at the end of the academic year, then in October before the beginning of the next academic year.(*) If a student fails a subject, he must take another examination in all subjects, not just in the one he failed. If he misses a second time, he repeats all courses. Examinations are oral: in theory they last only one half hour, but the writer has known some which took the better

part of two hours. They are public and in principle anyone may ask the student a question. The candidate has the liberty of presenting half the courses at the end of his first year and the second half at the end of the second, or all courses at the end of two years.

The choice of a career must be made by the time the student starts his higher studies, although at the undergraduate level (mostly at the end of the first year) switching majors is relatively easy within the same Faculty. This results from the similarity of the programs outlined by the legislator: the would-be geologist could change to geography, pharmacy, medicine, biology without great loss of courses.

A major and obvious difference between the program of the U. S. student and his European counterpart, lies in one's freedom to select courses and the other's compulsion to take all subjects with a choice left only at the graduate level. This is the philosophy of a legislated program versus that of a university selected curriculum.

The total number of hours to be devoted on each subject is set by the University, but each individual professor has the right to exceed that minimum if he estimates it necessary. This occurs frequently. The lack of freedom in subject choosing is perhaps compensated by the freedom given the student: attendance is not compulsory, no marks, except in laboratory work, are given during the academic year and the entire emphasis is on the final examination. Questions are seldom asked: the only opportunity to get additional information is during seminars and laboratory periods.

The Belgian student's schedule is far heavier than that of the American student: this is perhaps one of the reasons why extra-curricular activities as well as inter-collegiate athletics do not take any significant part in university life. The emphasis is definitely on formal instruction and no Physical Education is required. Universities, however, subject students to annual medical examination and medical advice is available free at most university clinics.

Field trips cover sometimes as much as two weeks and involve overnight stays. Visits to foreign countries are no exception. The main objective of the field work is to develop in the student "a sense of observation" and to give him an opportunity to "acquire the ability of interpretation in the field."

The diploma lists all the subjects, those required by law as well as the additional subjects demanded by the university and gives the title of the master essay: the diploma thence fulfills the role played here separately by the diploma and the transcript. Marks are never disclosed and remain confidential. Attrition is great, especially after the first "candidate" year and runs normally to about 65%. Diplomas can be granted with honors, high honors, the highest honors.

A doctoral degree can theoretically be obtained one year after getting the Licenciate.

The author knows of no case where this actually occurred: two or more years of arduous work are normally necessary to get the coveted "Doctor" title. Contrarily to the practice in the U. S., France or Germany, the student takes no

courses: he selects a topic and works under the guidance of an advisor, the rapporteur or director de thèse. A thesis is always a substantial volume and usually contains one or more positive or negative propositions, although lately some theses seem to lean more towards the dissertation type. Individuality is the main object. Doctor degrees are given by the Faculty in which the student graduates, hence the Doctor of Philosophy is granted by the Faculty of Philosophy, the Doctor of Letters by the Faculty of Literature, etc. The geologist gets a Doctor of Science degree.

There are only two types of degrees and diplomas: those bestowed by Law and those merely bestowed by the University. The legal degree is considered to be of greater weight than the "scientific" degree granted by the University. Scientific degrees are sought by those students who do not fulfill the legal requirements for admission but were received anyhow by the university after an examination taken before a University Jury. Legal degrees only grant access to official positions. Scientific degrees are just as useful for those who intend to enter private industry.

There aren't as many outlets for geologists in Belgium as in the United States and proportionally far fewer students major in geology. Yet, there is a great shortage of geography teachers at the high school level, excellent appointments incidentally, since high school teachers have scedules, obligations and prestige comparible to college professors in the U. S.; geologists are eligible for these positions. Very few openings exist at the university level and the competition for these is more than keen. Private industry will look for geologists specialized in economic geology or physical geography (Congo). There are outlets in various government agencies: Armed Forces, Military Cartographic Institute, Belgian Congo or Ruanda-Urundi administration; furthermore geologists are eligible as any other university graduate (graduate level only) to occupy the highest administrative offices in the State, Provincial or Municipal government. They are granted reserve commissions after completing eighteen months of non-commissioned military service under Belgium's compulsory national service system.

FOOTNOTE

(*) Except after World War II; the University of Brussels, closed during the German occupation because it was "the hideout of agonizing democracy", was granted permission to hold continuous sessions for students' whose studies had been interrupted by the Occupation Power edict.

Structural Geology Laboratory Manual. John C. Ludlum and John M. Dennison. vii 108 pp., 47 figs. Morgantown, W. Va.

This manual, based on a series of exercises used for some years at West Virginia University, "has been planned as a complete laboratory workbook for students taking their first course in structural geology." It is intended that use of the manual should (1) develop and test the student's reasoning power, (2) train the student to consider and visualize rock sections in three dimensions, and (3) therefore prepare the student for later courses in field geology.

The manual contains 122 exercises distributed among 10 chapters, each chapter covering a standard laboratory topic in structural geology, such as Structure Sections, Thickness Determinations, Depth to Dipping Strata, Outcrop Patterns, True and Apparent Dip, Structure Contours and Isopachs, Faults, Analysis of Attitudes of Planar and Linear Structures, Stereographic Projection, and the Interpretation of Geologic Maps.

Large 8½ x 11″ pages which can be removed from a reasonably strong looseleaf binder constitute, perhaps, the most attractive feature of this manual. Maps and other figures, on which exercises requiring graphical solutions are based, are large enough to justify fairly rigid requirements for accuracy. The quality of paper and printing is excellent.

In general, the various topics previously listed are well-handled. The chapter on Structure Sections is excellent and contains a great deal of practical information not usually found outside of scattered paragraphs in texts on field geology. For example, there is a section on alteration of scale which includes rather complete discussions on the use of scales and dividers, photographic methods, and several geometric methods.

In chapters dealing with problems involving maps, exercises are provided for use with various folios of the Geologic Atlas of the United States (U. S. Geological Survey).

Notable also is the presence of a chapter on planar and linear structures, an important topic which is often neglected.

There are many more "mathematical descriptions" (i.e. formulas) presented in this book than are usually available and most of them are derived. However, as in the textbooks, a formula for the solution of the "three-point problem" is stated, but not derived.

The chapter on stereographic projection could be improved. Although several good examples of problems which can be solved by stereographic projection are provided, the very brief explanation of the basic principle involved is insufficient to provide the student with real understanding. Problems involving rotation of the spherical projection about a horizontal axis are included, but there are no problems involving rotation about an axis inclined to the projection.

The authors of this manual have been successful in producing a set of exercises which should provide the beginning student of structural geology with the necessary tools to make the transition from course work in structural geology to practical application in certain aspects of field geology. However, those who would hope for a new approach in making use of the structural geology laboratory will be disappointed. The format of this manual is essentially traditional.

J. Donald Ryan
Lehigh University

Principles of Stratigraphy. Carl O. Dunbar and John Rodgers. xii + 356 pp. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. $10.00

Time was when text books of stratigraphy were almost purely descriptive. They consisted of enumerations of rock units, their thickness, lithologic character, and fossil faunas. The competence of a geology student in stratigraphy was judged by his ability on the one hand to recite long catalogues of formation names, in their correct order, and on the other to produce instantly the age of a given formation as soon as its name was mentioned. Stratigraphy of this particular brand is thoroughly disliked by the poorer student who cannot remember the catalogue and even by the better student, who can do so but wonders if the result justifies the effort.

The trend in the last twenty or thirty years has been toward synthesis, toward the establishment of principles rather than extension of the catalogue of formations. Stratigraphers felt that principles governing the study of

sedimentary rocks could be adduced from the enormous mass of data available in the literature of geology, but the majority of them were so fully occupied with description of local sequences and correlations that they could not see the woods for the trees. The interpretation of sedimentary rocks, by default, was left to the paleontologist, the sedimentary petrographer, the paleoecologist, or the paleogeographer. Their disciplines, by tacit agreement, were considered outside the province of the "true" or "pure" stratigrapher.

Limitation of the stratigrapher's interests led to a restriction of the scope of stratigraphy which, by virtue of such narrowness of outlook, could produce only descriptions of rock sections and correlations of ever-smaller units with each other. Useful as these data may be, they are not the be-all and end-all of a science.

Dunbar and Rodgers realize the importance of description and correlation but they expand the scope of stratigraphy to include interpretation of rock units; therefore they devote much attention to sedimentary environments. This book is no dry and detailed catalogue of formations. Local rock sequences are used as examples but they are subordinated throughout to general principles. Environments of deposition are studied first, then basic stratigraphic relations (stratification, breaks in the record, facies and facies changes). Next comes interpretation of specific lithotopes, as concise and clear a statement of the subject as any geologist can ask for. Finally, part IV, Synthesis, brings together the principles developed in the other three parts and shows how they can be applied first to the local section, then to units and areas of increasingly larger size.

The discussion of the stratigraphic system (p. 289) is clear and up-to-date; it constitutes a history of its development which includes the recent actions of the American Commission on Stratigraphic Nomenclature.

The concluding section on "Broad patterns in the distribution of sedimentary rocks" is highly recommended to the beginning geologist who is confused by current terminology for broad groupings of sedimentary rocks.

An extensive bibliography, combined with an author index, is an important part of this book. It is not restricted to recent (i.e. post-1925) works in English but lists important references on stratigraphy, whatever the language in which they were published.

To sum up, this text book is a refreshing departure in the teaching of stratigraphy. The next generation of geologists will be better off for having been introduced to the subject through this method instead of older and less sound ones. Perhaps this book will cause them to remember stratigraphy with pleasure instead of pain. Let us hope so, for it is high time for us to present the subject in a more attractive and more logical way. This book presents a method that should achieve that goal.

AURELE LA ROCQUE
The Ohio State University

TRANSACTIONS
OF THE
ASSOCIATION OF GEOLOGY TEACHERS

PACIFIC NORTHWEST SECTION

A scheduled meeting for business of members of the Association of Geology Teachers attending the Northwest Scientific Association meetings was held in Bagley Hall, University of Washington, Seattle, on December 28, 1956. This convened at 11:50 A.M., following delivery of two papers presented by members to the Geology-Geography Section of the Northwest Scientific Association.

Copies of the proposed By-Laws for the Pacific Northwest Section and the Constitution of the AGT were distributed by the acting Secretary-Treasurer, who also presided. A motion was made by Dr. Earl Hill to include Alaska, Montana and the province of British Columbia, Canada within the regional sectional boundaries with Oregon, Washington and Idaho. This motion was duly seconded and passed without dissent. A motion was made and seconded that the By-Laws be approved. This was passed unanimously.

A nominating committee of Earl Hill and Marie Pabst submitted a slate of officers for the Pacific Northwest Section, who were elected unanimously. (See inside back cover).

It was agreed to meet again with NSA in December, 1957, in Spokane, Washington. Meeting adjourned at 12:10 P.M. Members attending this meeting were Bressler, Campbell, Cook, Grimm, Pabst, Scott and Thatcher.

Respectfully submitted,

EDWARD P. THATCHER,
Secretary

FAR WESTERN SECTION

The third annual meeting of the Far Western Section of the Association of Geology Teachers was held on the campus of San Jose State College, March 23-24, 1957. The theme selected for the meeting was "Qualifications and Preparation of Teachers of the Geologic Sciences". Keen interest in the theme was evidenced by the lively discussions and by the attendance. Seven papers were presented from the point of view of representatives of the teaching levels from grade school through the university. The annual banquet featured an address by Chester R. Longwell on the "Recruiting of Geologists". Marshall Maddock conducted a field trip to Mt. Hamilton vicinity that introduced the highlights of stratigraphy and structure. One of the intensely interesting glaucophane schist localities was visited. The University of Redlands was selected as the site of the next annual meeting.

Respectfully submitted,

FREDERICK C. GROS,
Secretary-Treasurer

EAST CENTRAL SECTION

The University of Michigan was host to the East Central Section for their annual meeting at Ann Arbor, March 15 and 16, 1957. The group gathered informally during the morning for coffee and conversation in the quarters of the Geology Department.

The afternoon session was a panel discussion of the subject, "The Philosophy of the elementary course in geology". Panel members were: Dr. James C. Brice, Washington University, St. Louis; Dr. Robert M. Garrels, Harvard University; Dr. Chauncy D. Holmes, University of Missouri; and Dr. William A. Rice, Mt. Union College. Dr. Wayne D. Martin served as moderator.

Dr. Holmes spoke first. In discussing the matter of course level he stressed the fact that we cannot hold students responsible for background information unless the prerequisite is specifically required. He asserted that the elementary course is of paramount importance since it establishes the reputation of the department in its relation to the rest of the university. Furthermore, we must proceed on the assumption that students come to the university for an education. We must make an effort to keep the elementary course abreast of new discoveries. While peripheral subject matter must be touched upon, we must remember that the central core of geology is the study of the history of the Earth and its inhabitants.

Dr. Rice, speaking from the point of view of the small, liberal arts college urged that

the student should seek to develop an appreciation of landscape and of his place in it. What material the professor covers in the course is of less importance than that it be carried to the point of real understanding by the students.

Dr. Garrels admitted that, regardless of the variations he had tried, he never was satisfied with the presentation. The major concepts he hopes that his students will gain are (1) that landscape is not eternal, (2) that the succession of sedimentary rocks is related to the succession of sediments accumulating today, (3) that materials in large chunks do not behave like materials in small chunks, and (4) some picture of the changes undergone by living things during the long span of geologic time. The method of presenting this material should, as far as possible, avoid the authoritarian, although it is admittedly difficult in a one year course to present evidence and teach students to reason from it. While we can hope that the students come to their first geology course with some background in high school algebra and chemistry so that some ideas may be developed along numerical and chemical lines, we must remember that a "quantitative" treatment is not the only valid approach. Many subjects should be treated inductively, but no less rigorously.

Dr. Brice stated that at Washington University chemistry, physics and geology are grouped as the Physical Sciences, one (at least) of which is required as a part of the curriculum of every student. Since the boundaries between the branches are arbitrary, the principles of physical science can, and should be taught just as well whether the course be called Chemistry, Physics or Geology. Consequently, much time in the first semester is devoted to such topics as atomic structure, refraction, specific gravity and the philosophy of classification.

A lively discussion followed in which the many speakers, although differing in opinion on many points, agreed that the elementary course should not try to cover too much material, that it should stress the principles of physical science as they are revealed in geology, but that the level at which the course is to be taught is really decided for us in the high schools. Dr. Shideler summed up the whole discourse when he pointed out that probably most students who take the beginning course in geology drift in, looking for an easy way to satisfy a science requirement. Our challenge is to stimulate the intelligent minority. To be interesting the course must be practical and avoid scientific gobbldy-gook beyond the students' depth. There is no set formula of teaching techniques to be employed since there are four variables in the situation; the personality, training and experience of the professor, and the quality of the student.

The annual business meeting of the section was held following the evening banquet. Thanks were expressed to the Department of Geology of the University of Michigan for their excellent arrangements and gracious entertainment. New officers were elected by mail ballot (see inside back cover). Floyd Nave was named representative to the national Nominating Committee. It was moved by Vincent Nelson, seconded by Kenneth Landes, that the East Central section contribute the sum of $50.00 toward the cost of printing the Spring issue of the Journal of Geological Education, and that other sections be urged to make gifts to relieve the Journal's financial stringency until some long range program can be established. Motion carried.

Miami University's invitation to hold the 1958 meeting at Oxford was accepted.

On Saturday morning the group was taken by University bus to examine some ice contact deposits of sand and gravel and to see the operation of a "Heavy Media Separation Plant" for the removal of objectionable pebbles from gravel. The party disbanded after lunch as guests of the Killins Gravel Company.

Respectfully submitted,

MILDRED F. MARPLE,
Secretary

CENTRAL SECTION

The 17th Annual Meeting of the Central Section of the Association of Geology Teachers was held April 1, 1957 at Kiel Auditorium in St. Louis, Missouri. There were about 35 in attendance.

Vice-President Boardman called the meeting to order and presented a brief sketch of the history and points of view of the Association of Geology Teachers. He pointed out

that a good number of geology graduates with bachelor's degrees, as well as those with graduate training, go into commercial and government work. With this in mind he had arranged a panel discussion titled "The Fate of our Product". The panel consisted of Dr. Carey Croneis of the Rice Institute, who represented the independent university's graduate school; Dr. Samuel Ellison, Jr. of the University of Texas, who represented the large state university graduate school; Dr. George Maxey, of the Illinois State Geological Survey, who represented the state surveys; and Col. Frank Goldstone of the Shell Oil Company, who represented the petroleum industry.

SUMMARY OF DR. CRONEIS' REMARKS

The problems that we have now will continue in kind though they may be increasing in degree. The experience at Rice where the Geology Department is only four years old but where previously many physicists and electronics engineers had gotten into geology through geo-physics shows that in general they need better training in basic sciences.

A study made of geology graduates from Chicago University showed that they seldom failed as geologists but any failure in their jobs was generally due to personal faults, and cannot be attributed to their training.

Of the graduate students at Rice, many, previous to graduate school, have never had to prepare a paper or give a seminar report. This is an experience which every student should have.

Most of the geology graduates will go into industrial work.

SUMMARY OF DR. ELLISON'S REMARKS

The University of Texas requires a qualifying examination for entrance into the graduate school, and graduates from all colleges in order to be admitted should be able to pass the Graduate Record Examination. At present, space limitations make it necessary to reject about half of the applicants in geology so that the University of Texas can exercise a considerable degree of selection of its students.

Of people getting degrees in geology in the United States, 8.3% come from the University of Texas. Of these, 62% go into petroleum work and 1.4% into teaching, 36% are unreported. Foreign work gets about one-half of those who receive degrees from the graduate school at the University of Texas.

SUMMARY OF DR. MAXEY'S REMARKS

About 15% of all geologists are employed by government agencies. This government work is frequently "service" work which is of an engineering nature. The research work approximates that done in industry. One of the attractions of government employment and teaching as distinguished from industrial work is that it is possible for a man to do research work in an area where his major interest lies.

Where do the government surveys get their geologists? They usually have to take the more inexperienced and less promising students particularly because of a lower pay scale. In general the surveys have to train a new employee for a year or two. Students with bachelor's degrees who are hired by government surveys seldom have adequate training in the physical sciences, especially in mathematics. In their geological training, their weakest point is that they are largely incompetent in map reading.

Many surveys encourage further study on the part of their employees.

SUMMARY OF COL. GOLDSTONE'S REMARKS

Shell Oil Company has two general classifications for its geologists. One group consists of a professional staff who carry on fundamental research in such areas as clay minerology, paleontology, stratigraphy, etc. The second group consists of those geologists who are directly engaged in the search for oil. At present this group numbers about 400 and will probably continue at about this number. The research staff numbers about 250 and will probably increase in size in the coming years.

People with bachelor's degrees will have difficulty obtaining a position with a major oil company. At this level of training, faculty recommendations about individual students are not very discriminating. Recommendations for students who have gone to graduate school are much more useful to the companies. Approximately 65% of the geologists hired by Shell Oil Company in 1946 had bachelor's degrees only. Of the geologists hired by Shell

in 1956 only 15% had terminated their studies at the bachelor's level. The future will put emphasis on professional training, since it is this research group which is increasing in number. The exploration geologist requires engineering skills so that he may effectively use geo-physics, petro-physics, and so forth. This requires extensive training in the basic sciences, particularly in mathematics. Employees who are hired for this exploration work receive about sixteen months of in-service training and course work given by the company at a cost of about $10,000 per employee.

Many geologists just graduated have difficulty in expressing their ideas, and particularly so when they have to do it before an audience. Since the exploration personnel commonly advance into administrative and management positions, their ability to express themselves is most necessary.

Discussion and questions followed. Dr. W. H. Bradley of the U. S. Geological Survey remarked that one who works for the U.S.G.S. should be able to find and properly cite references to the geological literature which many seem incapable of doing.

The business meeting was called to order by President Keith Hussey at 11:00 a.m. The reading of the minutes of the 16th Annual Meeting was dispensed with since they were printed in the Fall 1956 issue of the Journal of Geological Education. The slate of officers presented by the nominating committee was elected unanimously. (See inside back cover.) Dr. Chauncy D. Holmes, University of Missouri, was appointed Central Section member of the National Nominating Committee. The Treasurer's report was read and approved, the report of the Budget Committee was read and approved. These reports were placed on file.

President Hussey initiated a discussion of the continuity of the activities of the officers. Most particularly was this necessary for the Vice-President's position, since he is usually new as an officer and is responsible for arranging the programs for the annual meetings. President Berg of the National Association reported that the Association has a financial problem which may have to be met by an increase in dues or by contributions to the cost of publishing the Journal of Geological Education by the various sections. There are also plans for the National Association to organize a committee on curricula and standards and to publish a bibliography on geological education. Roger Spitznas of Augustana College announced that the Leland Horberg Memorial Fund of $325 had been given to the National Association. He suggested that it might well be used to publish the bibliography.

Respectfully submitted,
DOROTHY J. GORE,
Secretary-Treasurer

EASTERN SECTION

The Eastern Section of the Association of Geology Teachers held its seventh annual meeting on April 19-20 at Princeton University, Princeton, New Jersey with 45 geologists attending.

On the afternoon of April 19th, Erling Dorf conducted a field trip to the coastal plain to study Cretaceous and Tertiary formations and their fossils. At the same time, Franklyn B. Van Houten conducted a field trip to study the three upper Triassic formations of the New Jersey Triassic.

After the annual dinner Arthur Montgomery, section president, thanked the Princeton Geology Department for their invitation to Princeton. The business meeting was held at Guyot Hall starting at 9:00 p.m. Maurice B. Rosalsky read the treasurer's report which revealed that the funds of the Eastern Section have been steadily increasing for the past five years. He also read the membership report which showed that this has been the best year of growth of the Eastern Section since it was established. Last year at this time there were 96 members in the section. With five dropping out and 39 new members added, the section now has 130 members.

The slate of officers presented by the nominating committee (see inside back cover) were elected by mail ballot by a majority of the members of the section. Arthur Montgomery was elected as section representative on the national nominating committee for 1958 to elect officers for 1959.

After discussion, the Eastern Section voted unanimously to give the Journal of Geologic Education a Grant of $150.00 out of the funds

of the Eastern Section. After considering further the financial difficulties of the Journal, the Eastern Section passed the following resolution: "The Eastern Section recommends that the National Organization consider the advisability of changing the dues apportionment sending $2.50 to the National Treasury (which pays for the Journal) and retaining 50 cents per member in the local coffers for the coming fiscal year. The Eastern Section stands ready to change to this dues apportionment provided the other sections do likewise."

Maurice B. Rosalsky pointed out that the actual annual expenses of the section have averaged 42 cents per member for the last three years.

The section voted to accept the invitation to hold the annual meeting next spring at Lehigh University, probably as a joint meeting with the Geologic Section of the Pennsylvania Academy of Science.

After the business meeting Sheldon Judson spoke on the "Geology of the Princeton region" with maps and lantern slides. The evening meeting concluded with a slide symposium, with slides shown by Maurice B. Rosalsky and Kurt Lowe.

At 9:00 a.m. on April 20th at Guyot Hall, Princeton, the Eastern Section held a symposium on "Teaching Elementary Historical Geology at Colleges and Universities" under the Chairmanship of Erling Dorf. Lincoln Dryden of Bryn Mawr, James L. Dyson of Lafayette, John Imbrie of Columbia, Bernhard Kummel of Harvard, Robert LaFleur of Rensselaer Polytechnic, James S. Yolton of Upsala, and Kurt E. Lowe of C.C.N.Y. spoke. Although they had many and diverse ideas on the teaching of historical geology, they all agreed that textbooks should be deemphasized since they are apt to bore the students, especially those going no further into geology. They all agreed that discussion of principles can enliven and make more meaningful the catalogue of events and that taking up problems should be a most important feature of the course.

The meeting concluded with Hall Taylor of Columbia showing miniature stadia rods which the Geological Press of Columbia will soon have for sale. These accurate stadia rods can be used indoors for teaching purposes on rainy days or set up for exams indoors.

On December 1, 1956, the Eastern Section gathered at C.C.N.Y. for an informal meeting. A detailed discussion of this meeting will be found elsewhere in this issue.

Respectfully submitted,

MAURICE B. ROSALSKY,
Secretary-Treasurer

NEW ENGLAND SECTION

The annual meeting of the New England Section was held on April 12-13 at the University of Massachusetts with a group of 34 people, representing 16 colleges, in attendance. On Friday afternoon George Bain conducted a field trip to view features which serve as teaching aids in the Amherst area. At the annual dinner Friday evening President Joseph Trefethen's address was followed by a discussion and social hour.

Papers of the Saturday morning session dealt with some problems of the elementary course. At the afternoon meeting field work and mapping programs were considered. The success of the program was indicated by the very enthusiastic discussion which followed each paper.

A list of the officers elected to serve in 1958 will be found on the inside back cover of this issue of the JOURNAL.

SOUTHEASTERN SECTION

No formal meeting was held by the Southeastern section in 1957. A list of the new officers elected for the year 1957-58 will be found on the inside back cover of this issue of the JOURNAL.

Respectfully submitted,

WILLARD H. GRANT

THE ASSOCIATION OF GEOLOGY TEACHERS was founded in the Middle West in May, 1938. In November, 1951, it was organized as a national association, under which there are at present seven organized regional sections: Central, East Central, Eastern, New England, Far Western, Southeastern, and Pacific Northwest. An annual meeting of the national association is normally held in the fall, and sectional meetings are held in the spring.

The purpose of the Association, as stated in its Constitution, is "to foster improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences, and to disseminate knowledge in this field to the general public."

Anyone concerned with geological education, formal or informal and at any age level, is invited to apply for membership. *Inquiries should be addressed to the national secretary,* FREEMAN FOOTE, Williams College Williamstown, Massachusetts.

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